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(54) **HAND-HELD POWER TOOL WITH MECHANICALLY CONTROLLED AUTOMATIC ON AND OFF FUNCTION**

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B25B 21/02 (2006.01)

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CPC ***B25F 5/00*** (2013.01); ***B25B 21/02*** (2013.01)

(58) **Field of Classification Search**
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See application file for complete search history.

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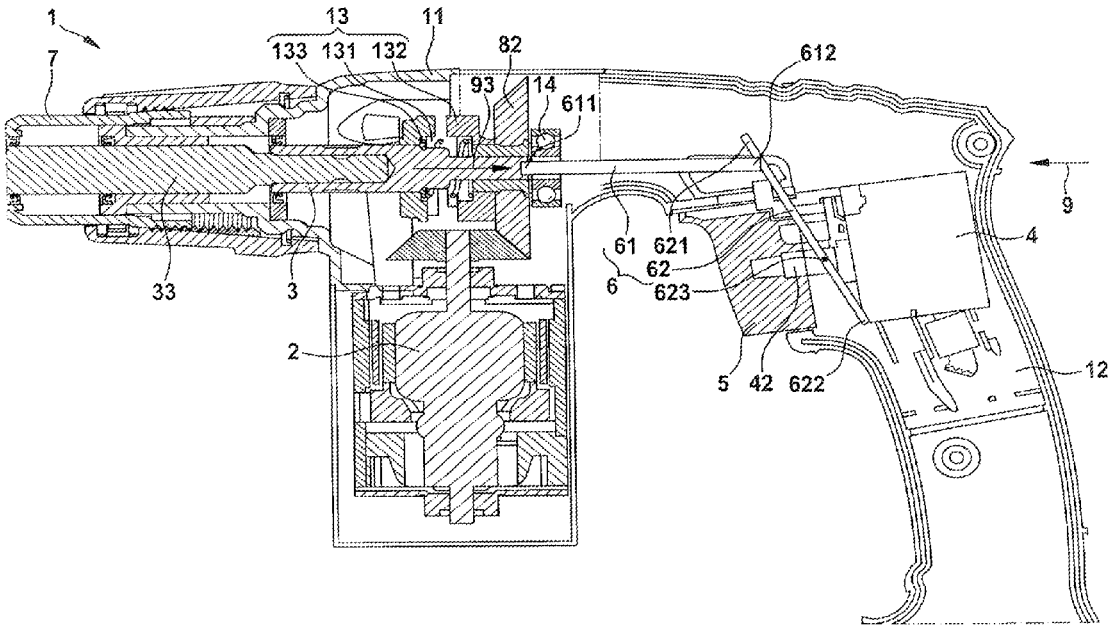
(57) **ABSTRACT**

A hand-held power tool includes a tool housing and a handle housing. The handle housing is movable relative to the tool housing. The hand-held power tool also includes an electric motor for driving the hand-held power tool. The electric motor is switched on and off by a relative movement of the handle housing relative to the tool housing. The hand-held power tool also includes a main electrical switch configured to apply an electrical voltage supply to the electric motor. The main electrical switch is switched by an actuating mechanism. The main electrical switch is actuatable with the aid of a movable component that is movable relative to the tool housing handily via the actuating mechanism, either directly or by the actuating mechanism.

9 Claims, 4 Drawing Sheets



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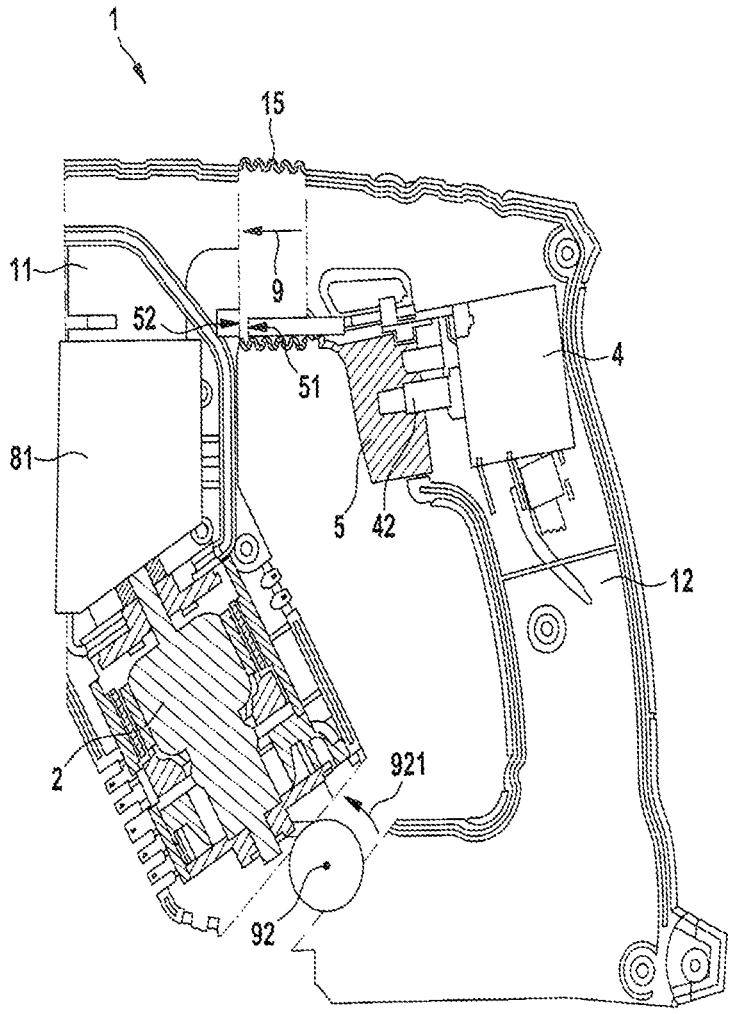
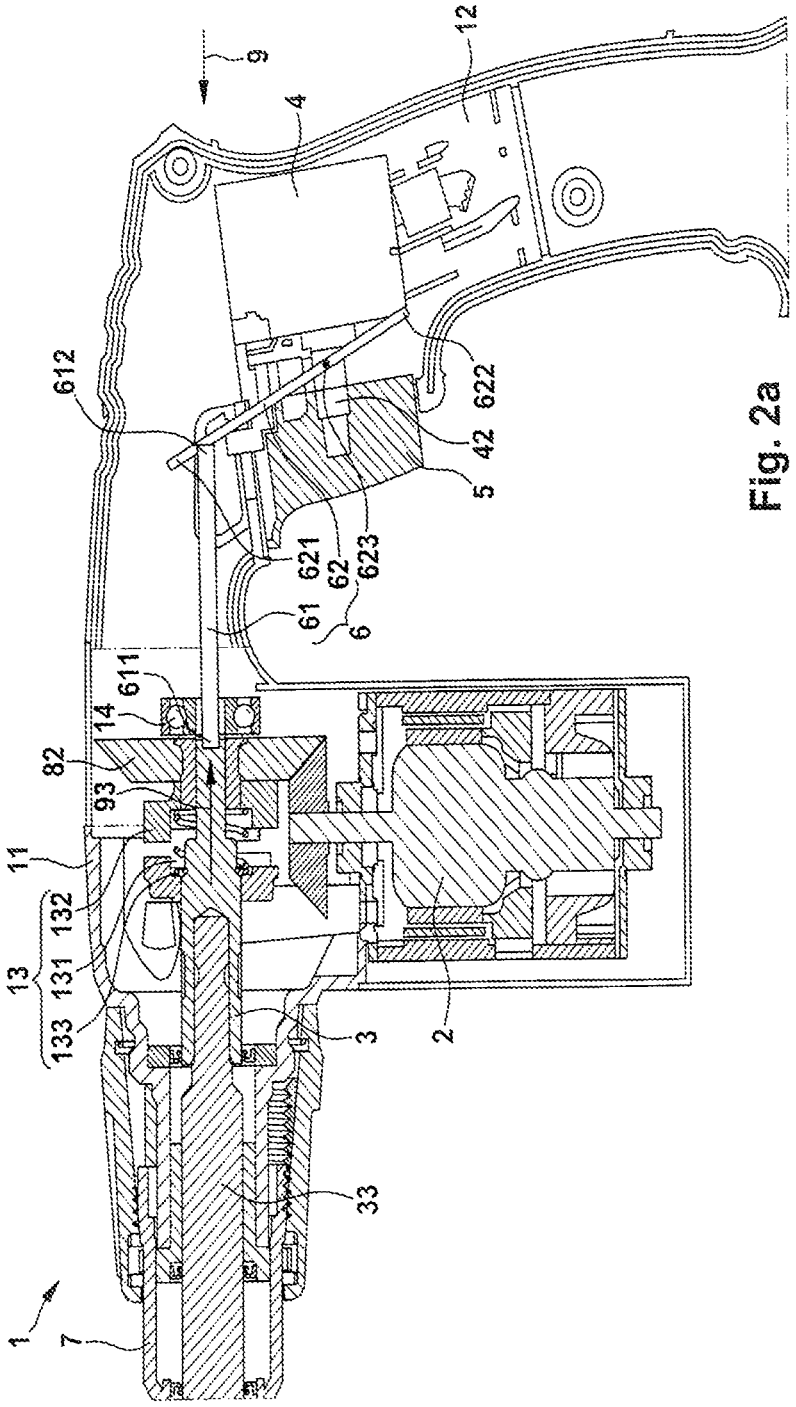


Fig. 1


9
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12
612
622
42
5
621
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131
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133
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1
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Fig. 2a

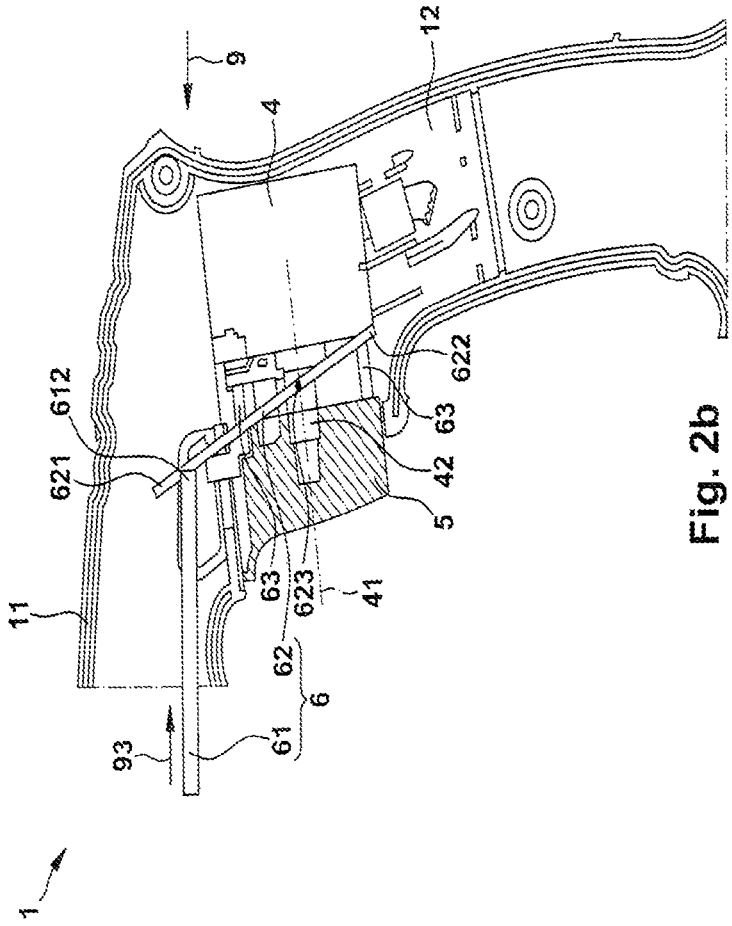

Fig. 2b

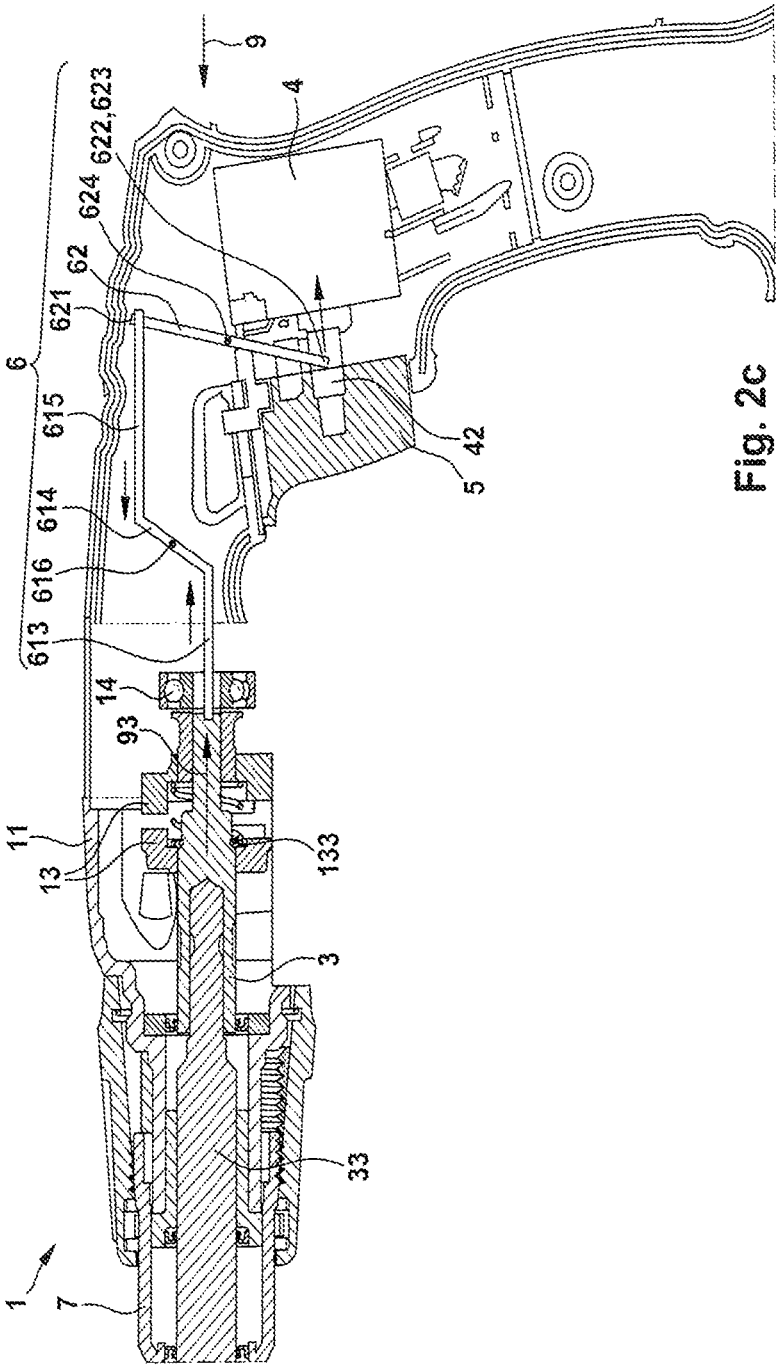

Fig. 2c

HAND-HELD POWER TOOL WITH MECHANICALLY CONTROLLED AUTOMATIC ON AND OFF FUNCTION

This application claims priority under 35 U.S.C. §119 to patent application no. DE 10 2011 084 432.5, filed on Oct. 13, 2011 in Germany, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

The present disclosure relates to a hand-held power tool, in particular a drywall screwdriver, with an electric motor for driving a tool, and with a tool housing and a handle housing, which is provided such that it is movable in relation to the tool housing. The present disclosure also relates to a hand-held power tool particularly according to the disclosure with the tool housing, the electric motor for driving the tool, and a main electrical switch for applying an electrical voltage supply to the electric motor, the main electrical switch being able to be actuated by an actuating mechanism.

Hand-held power tools, in particular drywall screwdrivers, of which the electric motor can be activated with the aid of the pressing force applied by the operator are known. These hand-held power tools have a main electrical switch, which can be handily actuated by an actuating mechanism or actuating mechanism. Moreover, they have a second switch, which is connected parallel to the main electrical switch of the hand-held power tool and with which the electric motor is activated when the pressing force goes above a limiting pressing force and deactivated again when it goes below it. The second switch is in this case actuated contactlessly, for example using optical or magnetic methods, or mechanically, for example using a pushrod.

In principle, virtually all electric tools, in particular rechargeable tools, require an electronic unit, with which the electric motor and/or a battery pack are controlled in order to operate the electric motor. This electronic unit is of varying complexity, and tends to be of a complex configuration gif sensor signals are detected and processed to allow the electric motor to be controlled in dependence on the sensor signals. Such an electronic system usually comprises a microprocessor for processing the sensor signals and for controlling the electric motor.

In comparison with hand-held power tools that merely provide the actuating mechanism for the main electrical switch, the hand-held power tools that have apart from the main switch a second switch in order to activate the electric motor in dependence on the limiting pressing force additionally require at least the parallel-connected second switch and the sensor system required for switching the second switch, along with the control mechanism and/or mechanical components. They are therefore of a comparatively more complex form. Moreover, the second switch and/or the sensor system/mechanical components are often arranged in the handle housing and require installation space there, which however is only available to a limited extent in the handle housing that should be formed as ergonomically as possible.

SUMMARY

The object of the present disclosure is therefore to provide a hand-held power tool, in particular a drywall screwdriver, that can be handled easily by an operator and provides an automatic on and off function, the requirement for components and/or installation space that is necessary for the on and off function, in particular in the handle housing, being minimized as much as possible, and the tool therefore being as simple as possible and able to be produced at low cost.

The object is achieved by a hand-held power tool, in particular a drywall screwdriver, with an electric motor for driving a tool, and with a tool housing and a handle housing, the handle housing being provided such that it is movable in relation to the tool housing, and the electric motor being able to be switched on and off by a relative movement of the handle housing with respect to the tool housing.

According to the disclosure, the hand-held power tool uses the relative movement of the handle housing with respect to the tool housing that is produced for example when the hand-held power tool is pressed against a workpiece for automatically switching the electric motor on and off. The handle housing is in this case preferably provided such that it is axially displaceable and/or rotatable in relation to the tool housing. The hand-held power tool can therefore be operated very easily.

In principle, the switching on of the electric motor with the aid of the relative movement of the handle housing with respect to the tool housing according to the disclosure is also possible by a second switch connected parallel to a main electrical switch. However, it is preferred that a main current flowing from the power source, for example the battery pack, to the electric motor is switched via the relative movement of the handle housing with respect to the tool housing.

In a preferred embodiment, which likewise achieves the object, the hand-held power tool has the electric motor for driving the tool and a main electrical switch for applying an electrical voltage supply to the electric motor, the main electrical switch being able to be actuated by an actuating mechanism, and the hand-held power tool comprising the tool housing, the main electrical switch also being able to be actuated handily by way of the actuating mechanism, and with the aid of a component that is movable in relation to the tool housing either directly or via the actuating mechanism.

Therefore, the main current of the hand-held power tool is switched on and off by the main electrical switch. The hand-held power tool consequently does not require a second switch, but instead the relative movement of the tool housing with respect to the movable component is used to allow either an actuating mechanism, with which an operator can also handily operate the main electrical switch, or the main electrical switch itself to be actuated. This hand-held power tool according to the disclosure is therefore less complex in comparison with a hand-held power tool with a second switch, and consequently can be produced at lower cost. Moreover, fewer components are arranged in the handle housing, so that it can be produced more ergonomically, and therefore such that it is nicer for the operator to handle.

In a first particularly preferred embodiment, the movable component is the handle housing of the hand-held power tool. In this case, the handle housing is preferably mounted rotatably in a direction of rotation about a housing point of rotation on the tool housing, so that, when the hand-held power tool is pressed against a workpiece, it rotates in relation to the tool housing about the housing point of rotation, in particular in the direction of the tool housing. It is likewise preferred for the housing point of rotation to be configured as a bending element.

Furthermore, it is preferred in this embodiment that an operating mechanism is provided on the actuating mechanism and a mating operating mechanism corresponding thereto is provided on the tool housing, said mechanism

interacting when there is relative movement of the handle housing with respect to the tool housing, so that the actuating mechanism is actuated.

The actuating mechanism is preferably provided at a distance from the housing point of rotation. As a result, an axial rotation component of the direction of rotation when the hand-held tool housing rotates about the housing point of rotation in the region of the actuating mechanism is greater than a transverse component arranged perpendicularly to the axial rotation component, so that the hand-held tool housing is moved in a virtually axial direction in the region of the actuating mechanism. As a result, the operating mechanism and the mating operating mechanism can be produced with a simple structural configuration.

Furthermore, it is preferred that the handle housing is fastened to the tool housing in the region of the actuating mechanism by a compliant holding element. The holding element is preferably a bellows element. The bellows element is preferably provided in a dust- and moisture-proof manner on the handle housing and on the tool housing, so that the interior space of the hand-held power tool is protected.

The hand-held power tool preferably comprises a spindle, on which the tool can be arranged. The tool is for example a bit holder, into which a screwdriver bit can be inserted.

It is particularly preferred for the spindle to be provided such that it is axially displaceable in relation to the tool housing, from a basic state, in which it cannot be driven, into an operating state, in which it can be driven by the electric motor. A hand-held power tool with such a spindle that cannot be driven in a basic state and can be driven in an operating state is for example a drywall screwdriver.

In a second particularly preferred embodiment, the movable component is the spindle. In this embodiment, the spindle moves in the axial direction when the hand-held power tool is pressed against the workpiece. As a result, the axial displaceability of the spindle that is in any case provided for example in the case of the drywall screwdriver is used for switching the hand-held power tool on and off.

It is preferred that a linkage which is connected to the main electrical switch or the actuating mechanism is provided on the spindle, so that the main electrical switch can be actuated with the aid of the linkage.

It is particularly preferred for the linkage to comprise a pushrod and a switching rod, which are connected to one another, the pushrod also being arranged on the spindle and the switching rod also being arranged on the main electrical switch or on the actuating mechanism. In this case, the pushrod is preferably provided such that it is rotationally decoupled from the spindle, so that it does not rotate along with the spindle when the spindle is being driven. The rotational decoupling preferably takes place with the aid of a spring-loaded ball. Furthermore, it is preferred that the switching rod is mounted rotatably on the main electrical switch, the switch point of rotation being arranged particularly preferably on an axis of the main electrical switch. In the case of this arrangement, the main electrical switch can be switched directly by the switching rod.

In a preferred embodiment, the pushrod and/or the switching rod are produced from a plastic, so that on the one hand they are very lightweight and do not significantly increase the weight of the hand-held power tool and on the other hand they can be produced at low cost. In principle, however, production from some other material is also possible, for example a metal or a metal alloy. It is also preferred for the pushrod and the switching rod to be produced as one part or as more than one part.

It is preferred with reference to all the embodiments mentioned that, when a pressing force goes above a limiting pressing force as a result of the hand-held power tool being pressed against the workpiece, the main electrical switch is actuated and the electrical voltage supply is applied to the electric motor. It is also preferred that, when the pressing force is subsequently reduced and goes below the limiting pressing force, the main electrical switch is once again actuated and the electric motor is disconnected from the electrical voltage supply.

It is also preferred that the actuating mechanism is mounted on the handle housing by a spring, in particular a compression spring. As a result, the actuating mechanism is not moved along at the same time when the main electrical switch is actuated by pressing the hand-held power tool against the workpiece.

The actuation of the main electrical switch directly or with the aid of the actuating mechanism, by the relative movement of the component with respect to the tool housing, can preferably be switched off, in particular by a mode switch. After switching off the automatic on/off function, the hand-held power tool can be switched on and off by pressing the actuating mechanism.

In a preferred embodiment, the hand-held power tool has an electronic unit, which is provided for controlling the electric motor and/or the battery pack. The electronic unit is operated by way of the main current switched by the main electrical switch and is interrupted in order to avoid the hand-held power tool continuing to be operated by way of the electronic unit when there is a short-circuit or defect. It does not require any sensor system with which the movement of the movable component in relation to the tool housing is detected. In this embodiment, if required, the voltage supply is applied to the electric motor by way of the electronic unit.

BRIEF DESCRIPTION OF THE DRAWINGS

The disclosure is described below on the basis of figures. The figures are merely given by way of example and do not restrict the general concept of the disclosure.

FIG. **1** shows a detail of an embodiment of a hand-held power tool according to the disclosure, the main electrical switch of which can be actuated by a relative movement of a handle housing of the hand-held power tool with respect to a tool housing of the hand-held power tool, and

FIG. **2** shows in FIGS. **2**(*a*)-(*c*) further embodiments of handheld power tools according to the disclosure, the main electrical switch of which can in each case be actuated by a relative movement of a spindle of the hand-held power tool with respect to the tool housing.

DETAILED DESCRIPTION

FIG. **1** shows a detail from an embodiment of a hand-held power tool **1** according to the disclosure, the main electrical switch **4** of which is actuated by a relative movement of a handle housing **12** of the hand-held power tool **1** with respect to a tool housing **11** of the hand-held power tool **1**. FIG. **1** schematically shows the tool housing **11** and the handle housing **12** of the hand-held power tool **1**. Arranged in the handle housing **12** is the main switch **4** and an actuating mechanism **5**, with which the main switch **4** is actuated. Arranged in the tool housing **12** is an electric motor **2**, with which the hand-held power tool **1** is driven. Also

arranged in the tool housing **12** is a spindle **3** (see FIG. **2**), which is driven by a gear arrangement **81** when the electric motor **2** is driven.

The main electrical switch **4** is provided for closing a voltage circuit (not shown) for a voltage supply (not shown) of an electric motor **2** driving the hand-held power tool **1** and is arranged in the handle housing **12**. It has a switching slide **42**, which is actuated by an actuating mechanism **5**. The actuating mechanism **5** has an operating mechanism **51**, which is formed here as a web and interacts with a mating operating mechanism **52**, which is arranged in the tool housing **11**. For this, the operating mechanism **51** has at an end facing the mating operating mechanism **52** a contour corresponding to a mating contour of the mating operating mechanism **52**.

In the region of the actuating mechanism **5**, the handle housing **12** is fastened to the tool housing **11** by a compliant holding element **15**, which is configured here as a bellows element. Furthermore, the handle housing **12** is mounted on the tool housing **11** rotatably about a housing point of rotation **92**. Moreover, it is axially prestressed by a resilient element (not shown), for example a spring, in order to prevent unintentional activation of the main electrical switch **4**.

When the hand-held power tool **1** is pressed in an axial pressing direction **9**, the handle housing **12** is pressed against the tool housing **11**, so that it rotates in a direction of rotation **921** about the housing point of rotation **92** in relation to the tool housing **11**. The housing point of rotation **92** is at a distance from the actuating mechanism **5**, so that the operating mechanism **51** is in this case displaced virtually axially in the pressing direction **9**, until it comes up against the mating operating mechanism **52**. Then, the operating mechanism **51**, and consequently the actuating mechanism **5**, is pressed counter to the pressing direction **9** and with it the switching slide **42** of the main electrical switch **4** is displaced counter to the pressing direction **9**. As a result, the switching slide **42** switches the main electrical switch **4**, so that the voltage circuit closes and the electric motor **2** is driven. It is preferred that the actuating mechanism **5** is only displaced counter to the pressing direction **9** when the pressing force goes above the limiting pressing force that is caused for example by a compression spring (not shown). In this embodiment, the relative movement of the handle housing **12** with respect to the tool housing **11** therefore enforces the actuation of the operating mechanism **51**. When the hand-held power tool **1** is pressed in the axial pressing direction **9**, the handle housing **12** is preferably rotated against a restoring force in relation to the tool housing **11**, for example by a spring, so that, when the hand-held power tool **1** is let go, it is rotated back. When it is rotating back, the switching slide **42** and the actuating mechanism **5** are pushed back, so that the main electrical switch **4** is switched again. As a result, the voltage circuit is opened again and the electric motor **2** is no longer driven.

The main electrical switch **4** can also be handily switched by an operator by pressing the actuating mechanism **5**.

Such a hand-held power tool **1** is for example a drywall screwdriver, which has a spindle **3** (see FIG. **2**), which is axially displaceable in relation to the tool housing **11** and, when the drywall screwdriver **1** is pressed against something, is displaced from a basic state G, in which it cannot be driven, in a pressing direction **9**, so that a coupling **131**, **132** (see FIG. **2**) arranged in the gear arrangement **81** is coupled and the spindle **3** is displaced into an operating state. In the operating state, the spindle **3** and a tool **33** that can be driven by way of the spindle **3** can be driven.

FIG. **2** shows in FIGS. **2**(*a*)-(*c*) further embodiments of hand-held power tools **1** according to the disclosure, the main electrical switch **4** of which can in each case be actuated by a relative movement of a spindle **3** of the hand-held power tool **1** with respect to the tool housing **11**. The spindle **3** is mounted rotatably in the tool housing **11** by a bearing **14** and is intended for driving a tool **33**. The tool is for example a bit holder for receiving a screwdriver bit. In FIGS. **2**(*a*) and (*b*) there can be seen a depth stop **7**, which limits a screwing-in depth of a screw inserted into the screwdriver bit. The spindle **3** can be driven by way of the electric motor **2** with the aid of a bevel wheel **82**.

The embodiments show in each case a drywall screwdriver, in which the spindle **3** is provided such that it is axially displaceable in relation to the tool housing **11**, from a basic state G, in which it cannot be driven, into an operating state B, in which it can be driven by the electric motor **2**. In the embodiments shown, the spindle is in the basic state G. In the following, the terms drywall screwdriver and hand-held power tool **1** are used synonymously.

Each of the drywall screwdrivers **1** has for this in each case a coupling **13**, which comprises two coupling parts **131**, **132**. When the drywall screwdriver **1** is pressed against a workpiece in the pressing direction **9**, the spindle **3** is displaced with the coupling part **131**, which is facing the tool, counter to the pressing direction **9** in a displacing direction **93** and comes into engagement with the coupling part **132**, which is facing away from the tool, so that the coupling parts **131**, **132** interact in a torque-transmitting manner in the operating state B.

For switching on the hand-held power tool **1**, it also has a linkage **6**, which comprises a switching rod **62**, which is arranged on the switching slide **42** of the main electrical switch **4**.

In the embodiments of FIG. **2**(*a*) and FIG. **2**(*b*), the switching rod **62** has a first end **621**, which is arranged rotatably at a second end **612** of the pushrod **61**, and a second end **622**, which is arranged rotatably on the handle housing **12** and/or on the electrical switch **4**. Furthermore, the switching rod **62** is rotatable about a switch point of rotation **623**, which is arranged on the axis **41** (shown in FIG. **2**(*b*)) of the switching slide **42**.

The pushrod **61** is arranged with a first end **611** on the spindle **3**, particularly in a rotationally decoupled manner, and, when the spindle **3** is displaced counter to the pressing direction **9**, is likewise displaced counter to the pressing direction **9**, so that the switching rod **62** rotates about its second end **622**. In this case, the switching slide **42** is displaced counter to the pressing direction **9**, so that the main electrical switch **4** is actuated. In these embodiments, the relative movement of the spindle **3** with respect to the tool housing **11** therefore enforces the actuation of the pushrod **61**.

When the drywall screwdriver **1** is pressed against something, therefore, not only is the spindle **3** displaced from the basic state G into the operating state B, but at the same time the main electrical switch **4** is pressed. The main electrical switch **4** can, however, also be handily switched by the operator, in that said operator actuates the actuating mechanism **5** arranged axially displaceably on the switching slide **42**.

The embodiments of FIG. **2**(*a*) and FIG. **2**(*b*) differ in that the actuating mechanism **5** of FIG. **2**(*b*) is supported by two compression springs **63** on the main electrical switch **4** and/or the handle housing **12**, so that, when the main electrical switch **4** is actuated, it is not displaced counter to the pressing direction **9** together with the switching slide **42**

by the relative movement of the spindle **3** with respect to the tool housing **11**. In this case, the second end **622** of the switching rod **62** is supported on a housing of the main electrical switch **4**.

By contrast with the embodiments of FIG. **2**(*a*) and FIG. **2**(*b*), the embodiment of FIG. **2**(*c*) has instead of a single pushrod **61** a pressing lever mechanism with a first pushrod **613**, a second pushrod **614** and a third pushrod **615**, which are arranged so as to make a transmission possible. As a result, a displacing path of the spindle **3** and of the first pushrod **613**, which is arranged on the spindle **3**, is less than an actuating path of the switching slide **42** when the spindle **3** is displaced counter to the pressing direction **9** when the hand-held power tool **1** is pressed against the workpiece.

For this, the first and third pushrods **613**, **615** are in each case rotatably fixed at opposite ends of the second pushrod **612**, which is mounted rotatably about a point of rotation **616**. The third pushrod **615** is also connected to the first end **621** of the switching rod **62**. The switching rod **62** is arranged with its second end **622** rotatably on the switching slide **42** and mounted rotatably about a point of rotation **624**, which here is provided approximately in the middle of the switching rod **62**. When the spindle **3** is displaced counter to the pressing direction **9**, the first pushrod **613** is therefore likewise displaced counter to the pressing direction **9**, so that the second pushrod **614** rotates about its point of rotation **616** and the third pushrod **615** is displaced in the pressing direction **9**. As a result, the switching rod **62** is rotated about its point of rotation **624** and the switching slide **42** is displaced with the second end **622** of the switching rod **62** counter to the pressing direction **9**, so that the main electrical switch **4** is actuated. In this embodiment, the relative movement of the spindle **3** with respect to the tool housing **11** therefore enforces the actuation of the first pushrod **613**.

Also in this embodiment, the main electrical switch **4** can be handily switched by the operator, in that said operator actuates the actuating mechanism **5** arranged on the switching slide **42**.

The coupling **13** of the drywall screwdriver **1** of FIGS. **2**(*a*)-(*c*) has a spring **133**, by which the coupling parts **131**, **132** are spaced apart from one another in the basic state of the spindle **3**. The spindle **3** is therefore adjusted from the basic state G into the operating state B counter to a restoring force of the spring **133**. When the pressing force goes below the limiting pressing force, the spindle **3** is displaced in the pressing direction **9** and the coupling parts **131**, **132** disengage. At the same time, the pushrod **61** or the first pushrod **613** is displaced with the spindle **3** in the pressing direction **9**, so that the switching rod **62** rotates back and the switching slide **42** is displaced back in the pressing direction **9**. As a result, the main electrical switch **4** is switched and the voltage circuit is opened, so that the electric motor **2** is no longer driven.

What is claimed is:

1. A hand-held power tool comprising:

a housing;

an electric motor positioned in the housing and configured to drive a tool about a drive axis;

a main electrical switch configured to selectively electrically connect an electrical voltage supply to the electric motor;

an actuating mechanism located partially exterior to the housing and configured to actuate the main electrical switch when pressed by an operator of the hand-held power tool; and

a movable component configured to secure the tool and further configured to be moved axially along the drive axis to actuate the main electrical switch; and

a linkage coupled to the movable component and configured to actuate the main electrical switch directly or via the actuating mechanism,

wherein the movable component is a spindle that is configured to be driven to rotate about the drive axis by the electric motor,

wherein the linkage comprises a pushrod connected to a switching rod,

wherein the pushrod is directly connected to the spindle, and

wherein the switching rod is directly connected to the main electrical switch or via the actuating mechanism.

2. The hand-held power tool of claim **1**, wherein the spindle is axially movable along the drive axis, the spindle being axially movable from a basic state, in which the spindle is not drivable, to an operating state, in which the spindle is drivable by the electric motor.

3. The hand-held power tool of claim **1**, wherein the pushrod is rotationally decoupled from the spindle.

4. The hand-held power tool of claim **1**, wherein at least one of the pushrod and the switching rod is produced from a plastic.

5. The hand-held power tool of claim **1**, wherein the switching rod is mounted rotatably about a switch point of rotation on an axis of the main electrical switch.

6. A hand-held power tool comprising:

a housing;

an electric motor positioned in the housing and configured to drive a tool about a drive axis;

a main electrical switch configured to selectively electrically connect an electrical voltage supply to the electric motor;

an actuating mechanism accessible from outside of the housing and configured to actuate the main electrical switch; and

a movable component configured to secure the tool and further configured to be moved axially along the drive axis to actuate the main electrical switch,

wherein the movable component is a spindle configured to secure the tool,

wherein a linkage is coupled to the spindle and is configured to actuate the main electrical switch directly or via the actuating mechanism, and

wherein:

the linkage comprises a pushrod connected to a switching rod;

the pushrod is directly connected to the spindle, and

the switching rod is directly connected to the main electrical switch or via the actuating mechanism.

7. The hand-held power tool of claim **6**, wherein the pushrod is rotationally decoupled from the spindle.

8. The hand-held power tool of claim **6**, wherein at least one of the pushrod and the switching rod is produced from a plastic.

9. The hand-held power tool of claim **6**, wherein the switching rod is mounted rotatably about a switch point of rotation on an axis of the main electrical switch.

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